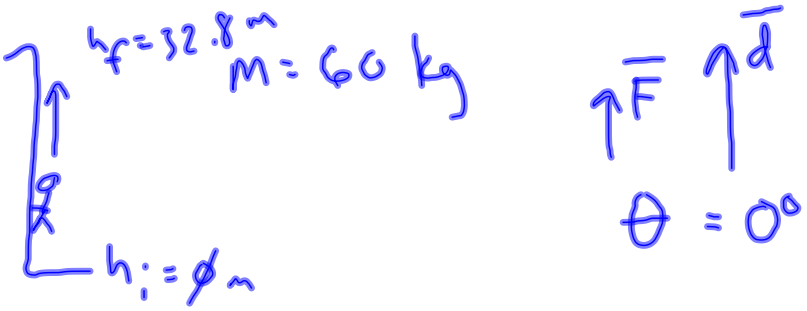
Work and Energy Review and Practice Problems 1st Block 11.1.11

A 60.0 kg climber scales a 32.8 m cliff.
a) How much work was done by the climber to lift herself up the cliff?
b) Standing at the top of the cliff, how much potential energy will the climber have? (Show calculations.)
c) If the climber accidentally falls from the cliff, how fast will she be traveling when she hits the ground?



a) $W = F_A d \cos\theta$ (1)

$= m a_g d$

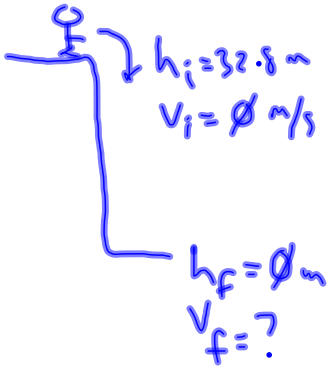
$= (60\text{ kg})(9.8\text{ m/s}^2)(32.8\text{ m})$

$= 19286$ J

b) $U_g = m a_g h_f$

$= 19286$ J

c) $K_i + U_{gi} = K_f + U_{gf}$ ($K_i = 0$, $U_{gf} = 0$)



$m a_g h_i = \frac{1}{2} m v_f^2$

$v_f = \sqrt{2 a_g h_i}$

$= \sqrt{2(9.8\text{ m/s}^2)(32.8\text{ m})}$

$= 25.4$ m/s

You must pull a rope connected to a pulley a distance of 6.99 m to accomplish a certain task. If this simple machine is 85.8% efficient, with how much force will you have to pull down to have the machine do 444 J of work for you?

$d_e = 6.99\ m$ $\quad IMA = \frac{d_e}{d_r}$ $\quad Eff = \left(\frac{Work\ out}{Work\ in}\right)(100\%)$

$Eff. = 85.8\%$ $\quad AMA = \frac{F_r}{F_e}$ $\quad = \left(\frac{AMA}{IMA}\right)(100\%)$

$W_o = 444\ J$ $\quad W_i = F_e d_e$

$F_e = ?$ $\quad W_o = F_r d_r$

$$\left(\frac{work\ out}{work\ in}\right)(100\%) = \left(\frac{AMA}{IMA}\right)(100\%) = 85.8\%$$

$$\frac{W_o}{W_i} = \frac{AMA}{IMA} = .858$$

$$\frac{W_o}{W_i} = \frac{\frac{F_r}{F_e}}{\frac{d_e}{d_r}} = .858$$

$$\frac{W_o}{W_i} = \frac{F_r d_r}{F_e d_e} = .858 \qquad W_o = F_r d_r$$

$$\frac{W_o}{F_e d_e} = .858$$

$$F_e = \frac{W_o}{(.858)\, d_e}$$

$$= \frac{444\ J}{(.858)(6.99\ m)}$$

$$= 74.0\ N$$

An armadillo bites and pulls down with a force of 40.4 N as he tugs a rope in a pulley system over a distance of .650 m. As a result, a 3.55 kg basket full of rocks lifts .250 m.
a) Calculate the AMA of the system.
b) Calculate the IMA of the system.
c) How efficient is this simple machine?

$F_e = 40.4N \qquad F_r = 34.8N$

$d_e = 0.65m \qquad d_r = 0.25m$

a) $AMA = \frac{F_r}{F_e} = \frac{34.8N}{40.4N} = .861$

b) $IMA = \frac{d_e}{d_r} = \frac{.65m}{.25m} = 2.6$

c) $Eff = \left(\frac{AMA}{IMA}\right)(100\%) = 33.1\%$

Which of the following contributes the most to the kinetic energy of a moving object?
a) the object's mass
b) the object's velocity
c) the object's height from the ground
d) gravity

$$K = \frac{1}{2}mv^2$$

A boulder is dropped from a very tall cliff. When it is about 5 feet from hitting the ground, which of the following is true? Select more than one, if needed.
a) The kinetic energy is equal to the potential energy
b) The total energy it has currently is equal to the total amount of energy it had at the top, before it was dropped
c) It currently has more kinetic energy than potential energy
d) The sum of its current potential and kinetic energies is the same as the amount of potential energy it had before it was dropped
e) The amount of potential energy it had at the top is equal to the amount of potential energy it has now (5 feet from the ground)